REMARKS

In response to the Office Action dated November 4, 2003 (Paper No. 16), claims 11, 93 and 94 have been amended. Claims 1-20, 93 and 94 remain in the case. Reexamination and reconsideration of the amended application are requested.

Section 103(a) Rejections

The Office Action rejected claims 1-7, 9-19, 93 and 94 under 35 U.S.C. § 103(a) as being unpatentable over Sambonsugi et al. (U.S. Patent No. 6,335,985) in view of Wakitani (U.S. Patent No. 6,031,568). The Office Action stated that Sambonsugi et al. disclose all elements of the Applicants' claimed invention except that "Sambonsugi et al. does not clearly teach a prediction module that provides predictions for a value of each of the plurality of pixels." However, the Office Action stated that Wakitani "teaches object tracking (abstract) in sequence image (column 1, lines 6-10) further comprises a prediction module (FIG. 2, box 62) that provides predictions for a value of each of the plurality of pixels (motion prediction value and motion prediction maps for each of the plurality of the pixels (column 14, lines 25-39)"). Therefore, the Office Action asserted that it would have been obvious to modify Sambonsugi's method of maintaining a background model for an image sequence according to Wakitani such that the combination would be able to predict motion values of each pixel and use them for motion mapping.

In response, the Applicants respectfully traverse these rejections based on the amendments to claims 11, 93 and 94, and the following legal and technical analysis. The Applicants submit that the combination of Sambonsugi et al. and Wakitani lack elements or features of the Applicants' claimed invention. In particular, Sambonsugi et al. and Wakitani do not disclose, either explicitly or implicitly, the following material claimed features: (1) providing <u>predictions</u> for <u>pixel values</u>; (2) providing these pixel value predictions for <u>every</u> pixel in an image; (3) providing two pixel value predictions for each pixel in an image <u>without using motion prediction</u>; and (4) calculating pixel value predictions for a pixel based <u>both</u> on an <u>actual history of pixel values</u> for the pixel and a <u>predicted history of pixel values</u> for the pixel.

Further, Sambonsugi et al. and Wakitani fail to appreciate the advantages of these claimed features. In addition, there is no technical suggestion or motivation disclosed in Sambonsugi et al. or Wakitani to define these claimed features. Thus, the Applicants submit that the combination of Sambonsugi et al. and Wakitani cannot make obvious the Applicants' claimed features set forth above.

To make a prima facie showing of obviousness, all of the claimed features of an Applicants' invention must be considered, especially when they are missing from the prior art. If a claimed feature is not disclosed in the prior art and has advantages not appreciated by the prior art, then no prima facie showing of obviousness has been made. The Federal Circuit Court has held that it was an error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Moreover, as stated in the MPEP, if a prior art reference does not disclose, suggest or provide any motivation for at least one claimed feature of an Applicants' invention, then a prima facie case of obviousness has not been established (MPEP § 2142).

Independent Claims 1, 11 and 16 and Dependent Claims

Independent claim 1 of the Applicants' claimed invention includes a system for maintaining a background model of an image sequence having a plurality of pixels. The system includes a pixel processing module that processes the image sequence on a pixel scale, and a prediction module that provides predictions for a value of each of the plurality of pixels. The system further includes at least one refinement module that processes the image sequence on a spatial scale other than the pixel scale.

Amended independent claim 11 of the Applicants' claimed invention includes a computer-readable medium having computer-executable modules including a pixel processing module that processes an image sequence on a pixel scale. The pixel processing module further includes a prediction module that predicts pixel values for each

pixel within the image sequence, and at least one refinement module that processes the image sequence on a spatial scale other than the pixel scale.

Independent claim 16 of the Applicants' claimed invention includes a method for maintaining a background model of an image sequence having a plurality of pixels. The method includes processing the image sequence on a pixel scale so as to determine a current background model and provide an initial assignment for each of the plurality of pixels. The method further includes calculating predictors for a value of each of the plurality of pixels, and refining the pixel processing by processing on a spatial scale other that the pixel scale to further refine at least one of: (a) the current background model; (b) the initial pixel assignments.

As admitted in the Office Action, Sambonsugi et al. do not disclose a prediction module that provides predictions for a value of each of the plurality of pixels. The Applicants' arguments supporting this fact are contained in previous responses.

. The Applicants also believe that independent claims 1, 11 and 16 include the following material features not disclosed by Wakitani:

"Providing predictions for pixel values":
The Applicants' claimed invention provides multiple predictions "about the value of a pixel in a subsequent frame" (specification, page 24, lines 4-5; emphasis added). This gives predictions of "what value a particular pixel will be in the next frame to be processed" (specification, page 25, lines 7-9; emphasis added). These pixel value predictions are used to determine whether to classify a pixel as a foreground pixel or a background pixel (specification, page 26, lines 21-23). Thus, background maintenance is achieved through the use of pixel value predictions.

In contrast, Wakitani merely discloses motion prediction values. Throughout Wakitani it is clear that the prediction being performed is prediction of the motion of target pixels, not pixel value prediction. Everywhere that Wakitani discusses prediction,

it is associated with motion. For instance, the motion prediction value map of Wakitani takes "account of both the direction and the magnitude of the prediction motion vector" (col. 8, lines 1-3; emphasis added).

In addition, the values discussed in Wakitani are values about a prediction of a pixel, and not prediction of the pixel value. More specifically, one type of "value about prediction of a pixel" that Wakitani discusses is a correlation value. A "value involved in an index of a degree of the approximation is referred to as the 'correlation value'" (col. 3, lines 9-10). A second type of value is a "prediction value, which indicates a maximum probability at an existence prediction position of the moving-target at the next position represented by the prediction motion vector" (col. 6, lines 45-48; emphasis added).

Wakitani provides further clarification about the "prediction value". Namely, Wakitani states that the "motion prediction value constituting the motion prediction value map implies that as its value is smaller, there is a high possibility that the target translated at the predicted position on the subsequent frame" (col. 14, lines 29-34). In other words, the prediction value of Wakitani indicates the worth of the prediction about as to where a target pixel is moving, as opposed to the pixel value itself.

The combination of Sambonsugi et al. and Wakitani also both fail to appreciate or recognize the advantages of the Applicants' claimed feature of providing pixel value predictions. In particular, pixel value predictions allow the Applicants' claimed invention to maintain a "reasonably accurate representation of the background so that the background and the foreground can be distinguished in each frame of the image sequence" (specification, page 2, lines 12-15). The combination of Sambonsugi et al. and Wakitani fail to discuss or appreciate these advantages of the Applicants' claimed feature of pixel value prediction.

"Providing pixel value predictions for every pixel in an image":

The Applicants' claimed invention provides pixel value predictions for <u>every pixel</u> in an image. As stated above, this gives predictions of what value each pixel "will be in the next frame to be processed" (specification, page 25, lines 7-9).

In contrast, Wakitani merely discloses performing motion prediction only on the pixels in the image that are being <u>tracked ("target pixels")</u>. The reason Wakitani does this is to know where to look for the pixels associated with the target they are tracking. In fact, "an important feature of the moving-target tracking apparatus according to the present invention resides in the point that . . . a motion of a target is predicted from the past motion of the target" (col. 6, lines 33-36). For example, if Wakitani selects "some player in a soccer game . . . as a target", then motion prediction only is performed for those pixels containing the soccer player (col. 7, lines 57-58). This is clear when it says that Wakitani "calculates a prediction motion vector as to a prediction for the target on the subsequent frame with respect to a translation of the target from the target position represented by the target position information" (col. 14, lines 18-22). Thus, Wakitani merely performs motion prediction on target pixels, which are a subset of all pixels in the image.

The combination of Sambonsugi et al. and Wakitani also both fail to appreciate or recognize the advantages of the Applicants' claimed feature of providing provides pixel value predictions for <u>every pixel</u> in an image. In particular, pixel value predictions allow the Applicants' claimed invention to maintain a "reasonably accurate representation of the background so that the background and the foreground can be distinguished in each frame of the image sequence" (specification, page 2, lines 12-15). Pixel value predictions for each pixel in an image allow the Applicants' claimed invention to classify each pixel in the image as either a background or a foreground pixel. The combination of Sambonsugi et al. and Wakitani fail to discuss or appreciate these advantages of the Applicants' claimed feature of providing provides pixel value predictions for every pixel in an image.

The Applicants, therefore, submit that obviousness cannot be established since the combination of Sambonsugi et al. and Wakitani fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature of pixel value predictions and providing these predictions for every pixel in an image. In addition to explicitly lacking these features, the combination of Sambonsugi et al. and Wakitani also fail to implicitly disclose, suggest, or provide motivation for these features. Further, the combination of Sambonsugi et al. and Wakitani fail to appreciate advantages of these claimed features.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Sambonsugi et al. and Wakitani does not render the Applicants' claimed invention obvious because each of the references is missing at least the two material features of the Applicants' claimed invention outlined above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that independent claims 1, 11 and 16 are patentable under 35 U.S.C. § 103(a) over Sambonsugi et al. in view of Wakitani based on the amendments to claim 11 and the legal and technical arguments set forth above and below. Moreover, claims 2-7, 9 and 10 depend from independent claim 1, claims 12-15 depends from amended independent claim 11, and claims 17-19 depend from independent claim 16 and are also nonobvious over Sambonsugi et al. in view of Wakitani (MPEP § 2143.03). The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claims 1-7 and 9-19.

Independent Claim 93

Amended independent claim 93 of the Applicants' claimed invention includes a system for background maintenance of an image sequence having a plurality of pixels. The system includesa pixel processing module that processes the image sequence on a pixel scale, and a prediction module that provides at least two pixel value predictions for

each of the plurality of pixels without using motion prediction. The system further includes at least one refinement module that processes the image sequence on a spatial scale different from the pixel scale.

The arguments provided above with regard to independent claims 1, 11 and 16 also apply to claim 93. In addition, the Applicants believe that amended independent claim 93 includes the following material feature not disclosed by Wakitani:

"Pixel value prediction for each pixel without using motion prediction":

As stated above, the Applicants' claimed invention provides multiple predictions about the value of each pixel in a subsequent frame. These pixel value predictions for each pixel are used to determine whether to classify a pixel as a foreground pixel or a background pixel. No motion prediction is used.

In contrast, throughout Wakitani it is clear that the prediction being performed is motion prediction. This motion prediction is of the motion of target pixels. Everywhere that Wakitani discusses prediction, it is associated with motion.

The combination of Sambonsugi et al. and Wakitani also both fail to appreciate or recognize the advantages of the Applicants' claimed feature of providing pixel value predictions. In particular, pixel value predictions allow the Applicants' claimed invention to maintain a "reasonably accurate representation of the background so that the background and the foreground can be distinguished in each frame of the image sequence" (specification, page 2, lines 12-15). The combination of Sambonsugi et al. and Wakitani fail to discuss or appreciate these advantages of the Applicants' claimed feature of pixel value prediction without motion prediction.

The Applicants, therefore, submit that obviousness cannot be established since the combination of Sambonsugi et al. and Wakitani fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature of pixel value predictions for each pixel without using motion prediction. In addition to explicitly lacking this feature, the

combination of Sambonsugi et al. and Wakitani also fails to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination of Sambonsugi et al. and Wakitani fails to appreciate advantages of this claimed feature.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Sambonsugi et al. and Wakitani does not render the Applicants' claimed invention obvious because each of the references is missing at least one material feature of the Applicants' claimed invention as outlined above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that independent claim 93 is patentable under 35 U.S.C. § 103(a) over Sambonsugi et al. in view of Wakitani based on the amendments to claim 93 and the legal and technical arguments set forth above and below. The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claim 93.

Independent Claim 94

Amended independent claim 94 of the Applicants' claimed invention includes a method for processing an image sequence having a plurality of pixels. The method includes processing the image sequence on a pixel scale to determine a current background model and provide initial assignments to each of the plurality of pixels. The method also includes calculating a plurality of predictors to provide predictions of a value of each of the plurality of pixels, the predictions based on an actual history of pixel values for the predicted pixel and a predicted history of pixel values for the predicted pixel. The method further includes refining the pixel processing by processing on a spatial scale other that the pixel scale to maintain a background model of the image sequence.

The arguments provided above with regard to independent claims 1, 11 and 16 also apply to claim 94. In addition, the Applicants believe that amended independent claim 94 includes the following material feature not disclosed by Wakitani:

<u>"Prediction based on an actual history and a predicted history of pixel values"</u>:

The Applicants' claimed invention provides two pixel value predictions for each pixel in the image. Specifically, the Applicants' specification sets forth a working example whereby there are two value predictions made for each pixel in an image. One of the predictions is based on <u>actual history</u> of the pixel values and the other prediction is based on the <u>predicted history</u> of the pixel values (page 28, lines 3-5). If the actual value of pixel differs from either one of its two predicted values by more than a certain amount, then that pixel is declared a foreground pixel (page 28, lines 2-3).

In contrast, as noted above, Wakitani merely teaches motion prediction. Moreover, unlike the Applicants' claimed invention, the prediction is not based on actual history and predicted history of values. In fact, the motion prediction in Wakitani is not based on a history of any sort.

The combination of Sambonsugi et al. and Wakitani also fails to appreciate or recognize the advantages of the Applicants' claimed feature of providing at least two pixel value predictions based on an actual history of pixel values for the predicted pixel and a predicted history of pixel values for the predicted pixel. More specifically, the use of multiple predictions "provides the pixel processing module 310 with the ability to accurately maintain a model of the background even if the background is briefly concealed by a foreground object" (page 28, lines 11-13). For example, if an actual pixel history and a predicted pixel history are used as two predictors for a value of each pixel, if one predictor becomes corrupted the other predictor will continue to predict the background (page 28, lines 13-15). The combination of Sambonsugi et al. and Wakitani simply fails to discuss or appreciate these advantages of this claimed feature of the Applicants' invention.

The Applicants, therefore, submit that obviousness cannot be established since the combination of Sambonsugi et al. and Wakitani fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature of providing at least two pixel value predictions based on an <u>actual history of pixel values</u> for the predicted pixel and a <u>predicted history of pixel values</u> for the predicted pixel. In addition to explicitly lacking this feature, the combination of Sambonsugi et al. and Wakitani also fails to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination of Sambonsugi et al. and Wakitani fails to appreciate advantages of this claimed feature.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Sambonsugi et al. and Wakitani does not render the Applicants' claimed invention obvious because each of the references is missing at least one material feature of the Applicants' claimed invention as outlined above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. <u>ACS Hospital Systems, Inc. v. Montefiore Hospital</u>, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that independent claim 94 is patentable under 35 U.S.C. § 103(a) over Sambonsugi et al. in view of Wakitani based on the amendments to claim 94 and the legal and technical arguments set forth above and below. The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claim 94.

The Office Action rejected claims 8 and 20 under 35 U.S.C. § 103(a) as being unpatentable over the combination Sambonsugi et al. and Wakitani as applied to claim 7, and further in view of Jain et al. (U.S. Patent No. 6,263,091). The Office Action contended that the combination of Sambonsugi et al. and Wakitani discloses all elements of the Applicants' claimed invention except for disclosing speckle removal. However, the Office

Action stated that Jain et al. disclose a technique to isolate foreground and background using speckle removal. Therefore, the Office Action asserted that it would have been obvious to use speckle removal as an enhancement technique because speckle removal is well known in the art to aid in the removal of noise, dirt, breaks and smudges in input images.

In response, the Applicants respectfully traverse these rejections based on the arguments above for independent claims 1 and 16. Based on the arguments, the Applicants respectfully submit that independent claims 1 and 16 are patentable under 35 U.S.C. § 103(a) over the combination of Sambonsugi et al. and Wakitani.

Jain et al. add nothing to the cited combination that would render the Applicants' claimed invention obvious. Jain et al. merely disclose a system and a method for segmenting foreground and background portions of digitized images. The Applicants' claimed features of providing pixel value predictions for each pixel in an image is not discussed. Consequently, no motivation or suggestion for this claimed feature of the Applicants' invention is provided. Absent this teaching, motivation or suggestion, Jain et al. cannot render the Applicants' claimed invention obvious (MPEP § 2143.01).

Jain et al. added to the combination of Sambonsugi et al. and Wakitani also still fails to appreciate or recognize the advantages of the Applicants' claimed feature of providing pixel value predictions for each pixel as outlined above.

The Applicants, therefore, submit that obviousness cannot be established since the combination of Sambonsugi et al., Wakitani and Jain et al. fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed features of providing pixel value predictions for each pixel in an image. In addition to explicitly lacking these features, the combination also fails to implicitly disclose, suggest, or provide motivation for these features. Further, the combination also fails to appreciate advantages of these claimed features.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Sambonsugi et al., Wakitani and Jain et al. does not render the Applicants' claimed invention obvious because the references are missing at least one material feature of the Applicants' claimed invention. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that independent claims 1 and 16 are patentable under 35 U.S.C. § 103(a) over the combination Sambonsugi et al. and Wakitani as applied to claim 7, and further in view of Jain et al. based the legal and technical arguments set forth above and below. Moreover, claim 8 depends from independent claim 1 and claim 20 depends from independent claim 16, and thus also are nonobvious over the combination Sambonsugi et al. and Wakitani as applied to claim 7, and further in view of Jain et al. (MPEP § 2143.03). The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claims 8 and 20.

Conclusion

In view of the amendments to claims 11, 93 and 93 and the arguments set forth above, the Applicants submit that claims 1-20, 93 and 94 of the subject application are in immediate condition for allowance. The Examiner is respectfully requested to withdraw the outstanding rejections of the claims and to pass this application to issue.

In an effort to expedite and further the prosecution of the subject application, the Applicants kindly invite the Examiner to telephone the Applicants' attorney at (805) 278-8855 if the Examiner has any comments, questions or concerns, wishes to discuss any aspect of the prosecution of this application, or desires any degree of clarification of this response.

Respectfully submitted,

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